I. An Introduction to NR Economics

1. (6 points) Define the following three concepts: state of technical knowledge, isoquants, and indifference curves. Use these three concepts in a discussion of the market’s ability or inability to partially offset the impacts of increased scarcity.

The state of technical knowledge describes all the different ways products can be produced given the current state of knowledge. As economists, we often describe the state of technology for producing a particular product with a production function. A production function for product $x$ identifies the maximum amount of $x$ than can be produced by every possible combination of inputs.

The isoquant for output level $x$ is all those combination of inputs that are just capable of producing $x$ units of output. “Iso” quant as in “equal” “quantity”. As compared to isocost, which is equal cost.

An individual’s indifference curve for bundle $x^o$ identifies all those bundles of goods the individual ranks indifferent with bundle $x^o$. That is, the indifference curve for $x^o$ identifies all those bundles of goods the individual considers no better or worse than bundle $x^o$. Sometimes indifference curves are referred to as “isoutility” curves.

If the price of a natural resource increases how much the market will be able to mitigate that increased scarcity through changes in production processes that use that natural resource will depend on the state of technical knowledge (the currently available techniques for producing products), and the ability of society to increases the set of available techniques (technical progress).

The state of technical knowledge determines the shape and position of isoquants. Technical progress makes them shifts inward.

When the price of a NR increases there is an increased profit incentive to find new ways to use less of that input. Technical progress has saved us from decreasing stocks and increasing demand for goods and services.

Isoquants tell us how easy it is to substitute one input for another. Specifically the slope an isoquant at a particular point (the marginal rate of technical substitution) identifies how much the producer has to increase the quantity of one input when the quantity of another input decreases, holding constant output. The more easily inputs substitute for one another in production the more
the use of a NR will decrease when its price increases. The market’s ability to mitigate increased scarcity through substitution in production will be maximized when the NR whose price has increased has a perfect substitute in production. The market’s ability to mitigate increased scarcity through substitution in production will be minimized when the NR whose price has increased is essential and has no substitutes.

An individual’s indifference curves tell us the individual’s willingness to substitute one good for another. Specifically the slope an indifference curve at a point (the marginal rate of substitution) identifies how much the consumption of one good has to increase when the consumption of the other good decreases by one unit to keep the individual indifferent. The more easily other goods substitute for natural resource intensive goods the more the consumption of NRIGs will decrease when their price increases. The market’s ability to mitigate increased scarcity through substitution in consumption will be maximized when the NRIGs whose price have increased have perfect substitutes in consumption. The market’s ability to mitigate increased scarcity through substitution in consumption will be minimized when the NRIGs whose prices have increased are necessary for life and have no substitutes.

Some comments:

Some of you in your discussion jumbled together substitution in production (input substitution) with substitution in consumption (the substitution of one good for another by the consumer). Goods and inputs are not the same thing, and isoquants have nothing to do with preferences.

We also need to distinguish between movements along an isoquant and shifts in the isoquant map.

When you draw graphs make sure to label the axis.

2. (4 points) Define the term rent (resource royalty) within the context of nonrenewable natural resources. In principles of microeconomics you learned that when a competitive firm is in competitive equilibrium its marginal cost of production equals the market price of the good it produces. For a competitive firm that extracts oil from a pool that it owns, in equilibrium will the marginal cost of extracting a barrel equal the market price of oil. Yes or No and explain.

Rent is the price at which a unit of the extracted ore would sell for above the ground minus the cost of extracting it. That is, it is the value of a unit of the resource insitu (in the ground). For the typical competitive firm, like the ones you learned about in principles and intermediate micro theory, how much they produce this year does not affect the amount they can produce in future years, so longrun and shortun profits are maximized in each year by producing up to the point where price equals the marginal cost of production. This is not the case for an extraction firm that owns the stock of ore they are mining. Every unit that is extracted is one less unit that can be extracted in the future. Therefore, for the extractive firm there is a cost of production in the current period above and beyond the cost of extraction; it is the lost value because one less unit is in the ground to extract or sell in the future. For the competitive extraction firm, profits are
maximized when price equals the marginal cost of extraction plus the value of the marginal unit of the resource in the ground (the rent).

Thinking about it in another way, imagine that you own the mineral rights to the reserves. Would you let someone extract them for free or would you charge them some amount for each unit extracted? Running a bit with this second thought, what would happen if the minerals were a common property resource?